BOARD COATING

With a history of board coating spanning back over many decades, Black Clawson are able to offer a wide range of coaters for your On machine or Off machine board coating process. Following is a summary of the coating process and the types of Coaters that Black Clawson Ltd. can offer for your board coating needs.

The reasons that paper mills coat their paper and board are many-fold. The main reasons are as listed below and are mentioned purely for your information.

- To improve printability
- To improve smoothness
- To change appearance
- To enhance surface characteristics
- To add value.

Single or multiply boards, as used in today's packaging and graphics arts industries are almost always coated on-machine.

Speciality coating of boards does take place on off-machine coaters but these are for converting processes such as Cast Coating, Extrusion Coating, etc.

Generally packaging board grades receive 2 (sometimes 3) coatings on the topside with a functional (starch, PVA) coating on the backside to aid fibre laydown and curl control. Coating weights vary according to coating method and desired product requirements but in general 20-25 g/m^2 of a pigmented clay coating is applied to the topside.

The method of application/metering also has an effect on the final product use, i.e. a rod or blade will improve the surface smoothness and printability whereas an air knife coater will improve the sheet opacity. Therefore, dependent on the end product any combination of the above may be warranted.

The four main types of coater employed on paper machines are

1. Metering Rod / Mayer Bar Coater
2. Flexrod Coater
3. Air Knife Coater
4. Blade Coater (Bent or Rigid) with either roll or fountain applicator.

Metering Rod / Mayer Bar Coater

The Metering Rod coater is still widely used today due to its simple operation and low cost in comparison to other coaters available.

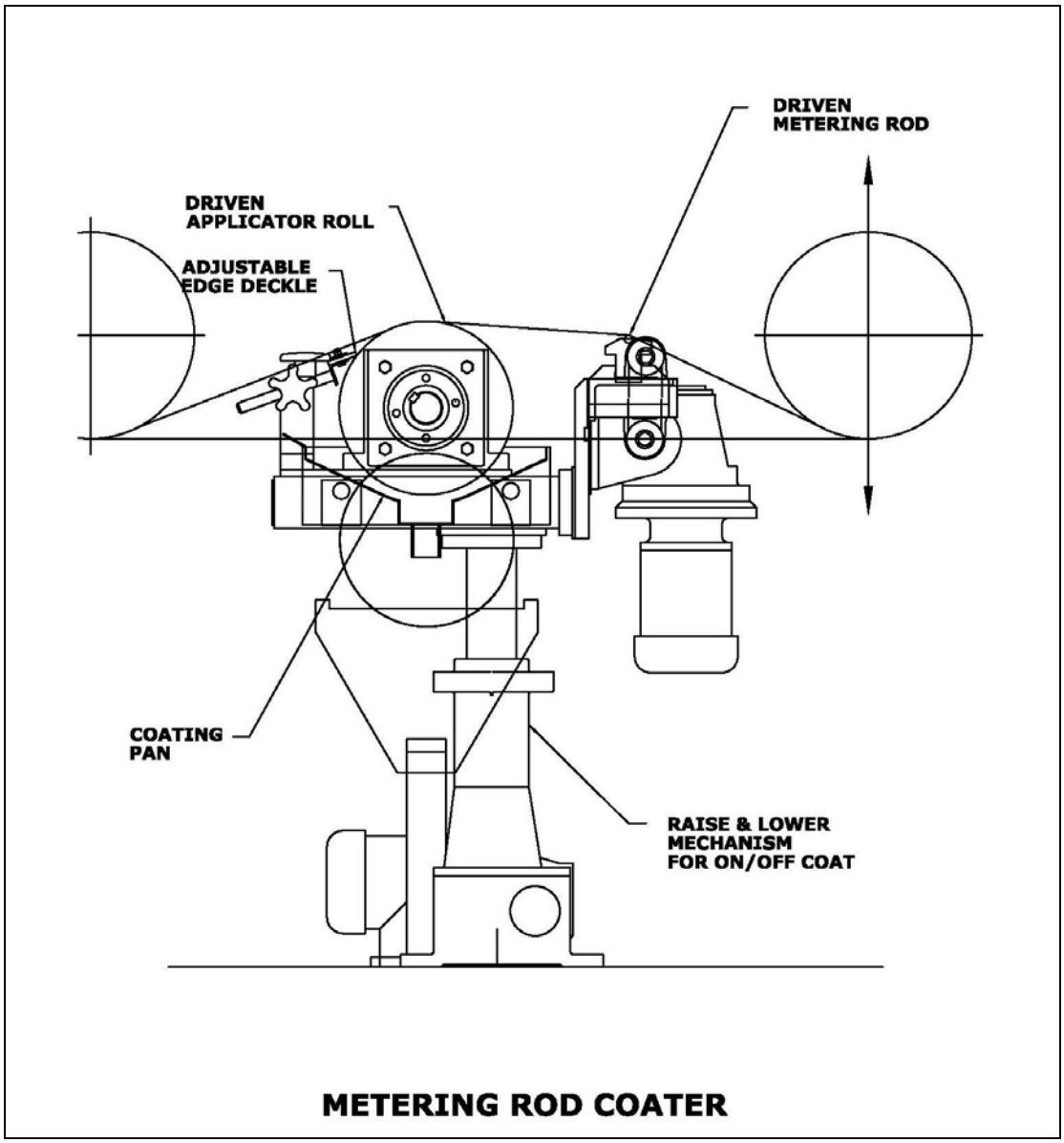

Fig 1. Metering Rod / Mayer Bar Coater

It employs the use of a pan fed kiss applicator roll which transfers an excess amount of coating to the web followed by either a smooth metering rod or wire wound mayer bar (wire wound rod) to smooth or meter the coating. Coating weight variations are made by either varying the web tension over the smooth rod or by employing wire wound rods with varying wire diameters, a larger wire diameter giving a higher coating weight. Coat weights can also be controlled by varying the angle of wrap on the applicator roll and metering rod.

These types of coater rod coater are predominantly used as a pre coater or back wet coater for boards because the nature of its operation allows it to give the board maker an extremely smooth base on which to apply the secondary or top coating.

Strengths

- Simple design
- Easy to operate
- Adapts easily to existing equipment
- Wire size used to control wet film thickness
- Will handle a wide range of coated products

Weaknesses

- Tension sensitive for coat weight
- Speed sensitive
- Little coat weight control except via changing wire size or rod diameters.

Flexrod Coater

A development on from the Metering Rod Coater is the Flexrod Coater, whereby the rod is loaded, via a pneumatic loading tube, onto a backing roll. By varying the air pressure and therefore the rod load pressure, the coating weight can be controlled. Profiling screws are used to profile the rod to the backing roll.

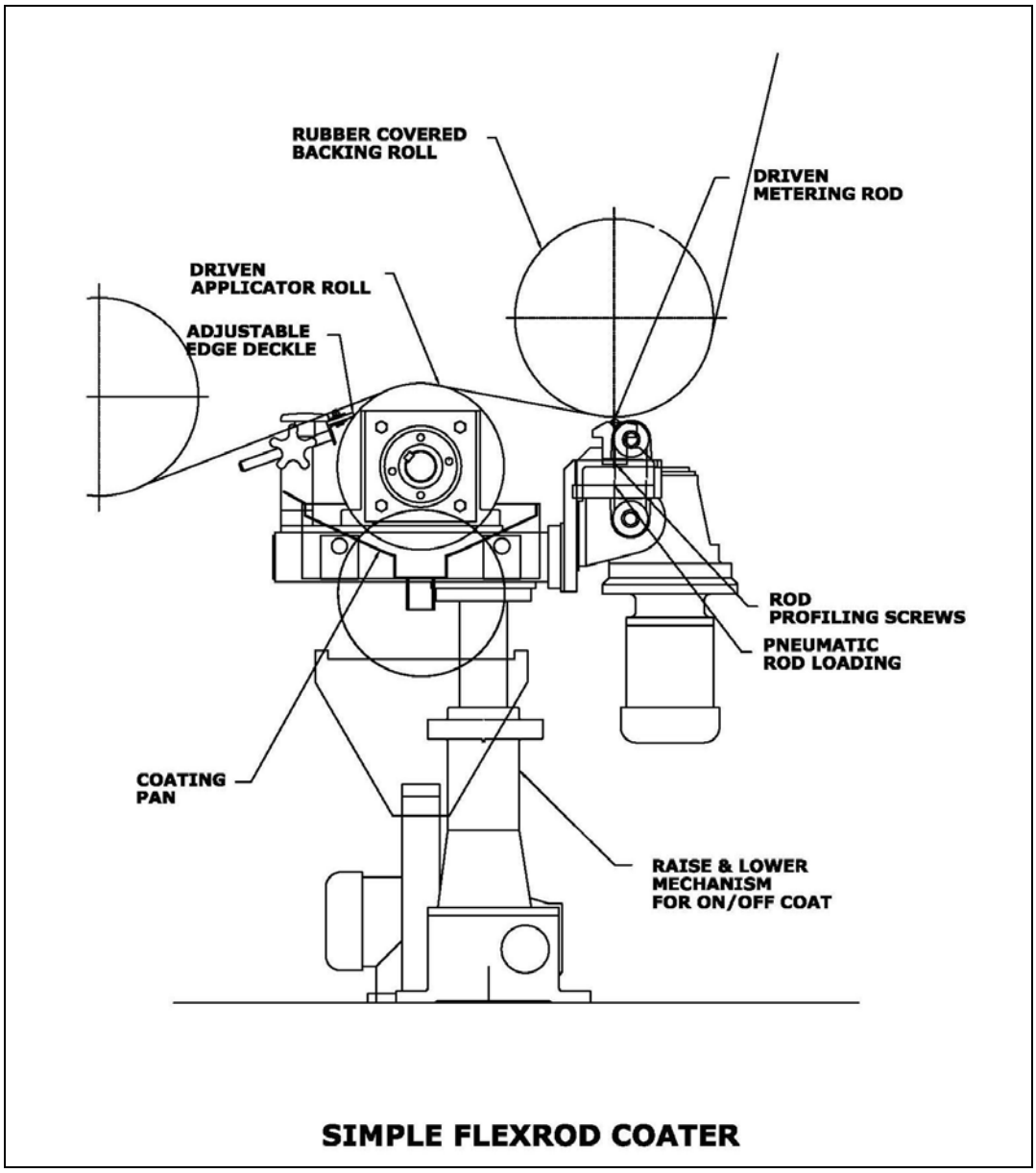

Fig 2. Simple Flexrod Coater

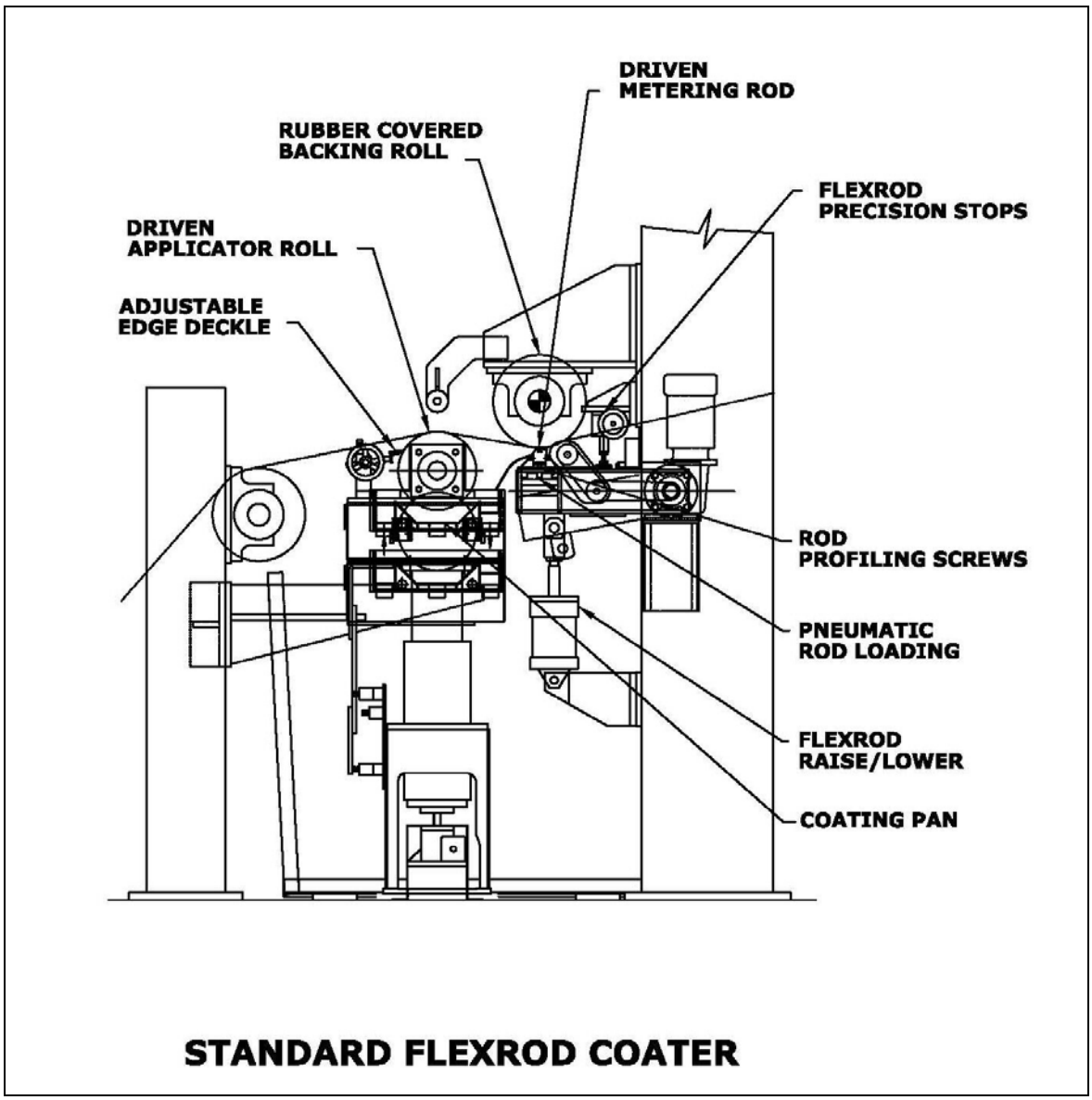

Fig 3. Standard Flexrod Coater for greater versatility.

Again predominantly used as a pre coater or back wet coater for boards, however the Flexrod Coater gives the boardmaker more control over the coating to be applied and a wider range of operation than the Metering Rod Coater.

The Flexrod Coater can also be employed as a top coater to a pre coated web.

Strengths

- Simple design
- Easy to operate
- Adapts easily to existing equipment
- Coat weight control via air pressure
- Produces a level surface
- Will handle a wide range of coated products

Weaknesses

- More expensive than Metering Rod Coater

Air Knife Coater

The Air Knife Coater operates again by utilising the pan fed kiss roll applicator applying an excess of coating to the web. The coating is then metered and smoothed from the sheet using a jet of air through a specially designed adjustable Air Knife, accurately directed onto the coating layer to shear the fluid. The excess metered coating is collected by an Air Separation Pan. The Separation Pan design changes for high speed applications.

The Air Knife Coater gives a coating layer which contours the paper achieving an even coating thickness over the sheet.

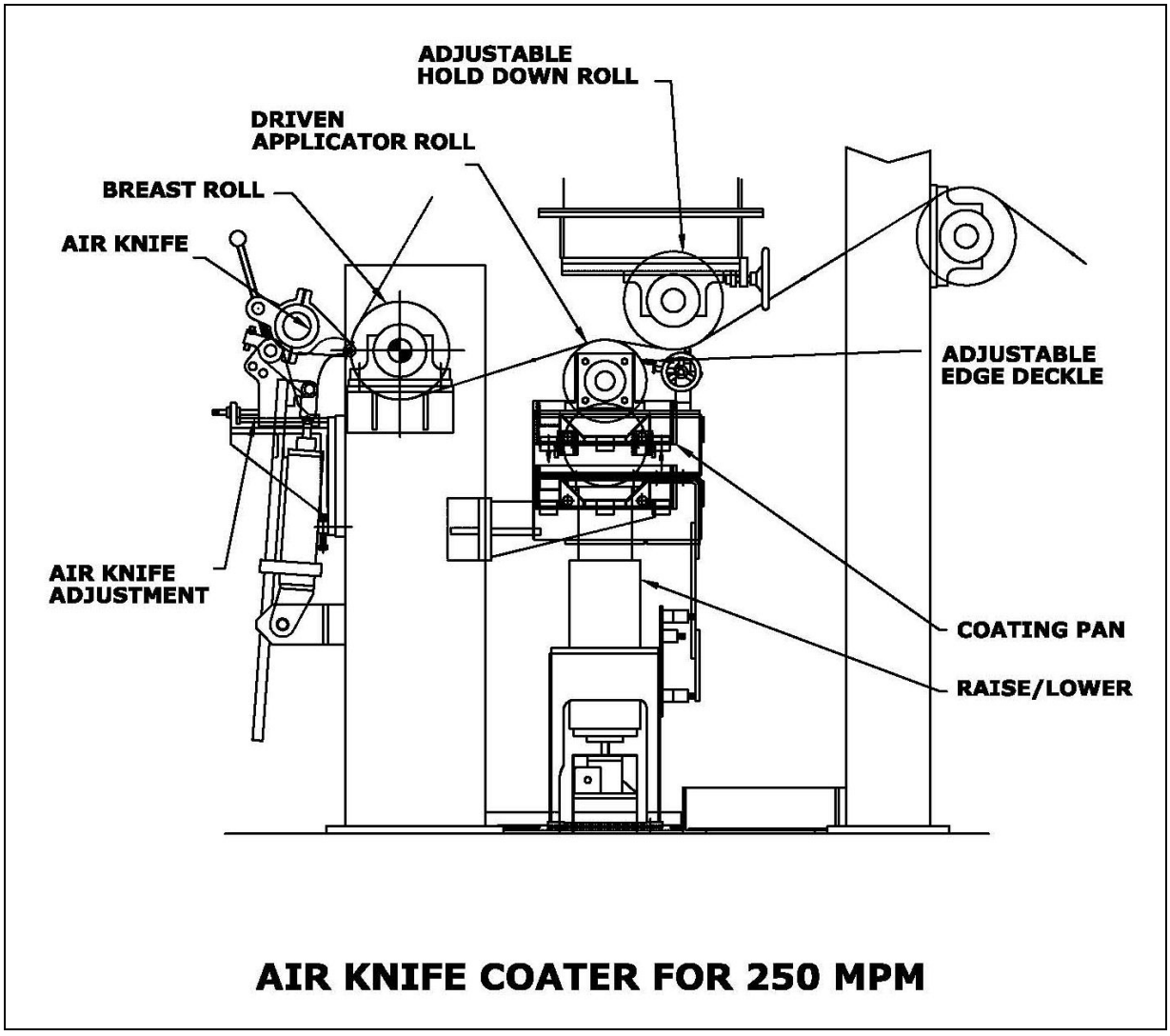

Fig 4. Simple Air Knife Coater for speeds up to 250mpm

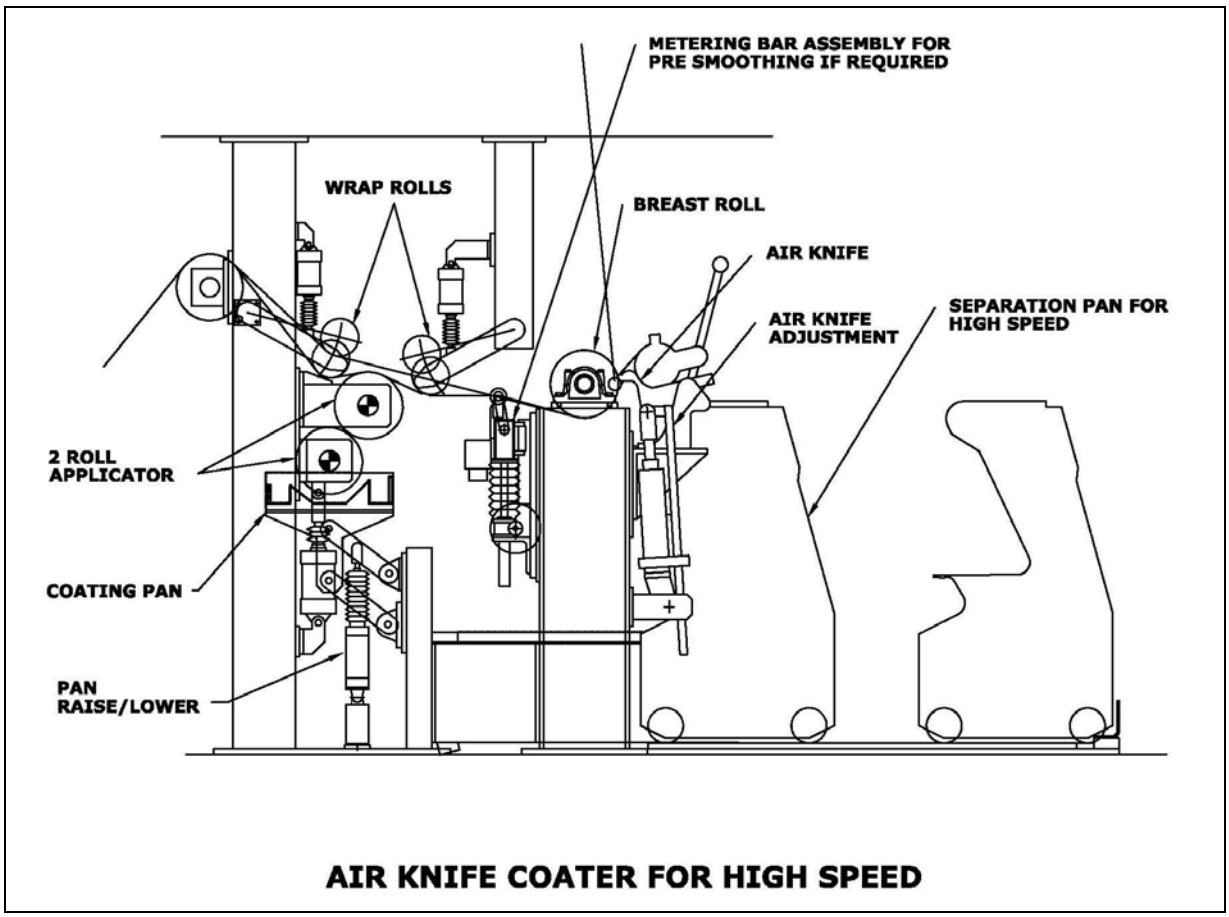

Fig 5. Air Knife Coater for speeds up to 500mpm

This method is popular for top coating of board after a Metering Bar or Flexrod Coater. This coater works well for low solids, low viscosity coatings.

More accurate coating application can be achieved with the use of multiple roll applicators.

Coating can be smoothed using a rod or roll prior to the Air Knife metering.

The setup of the Air Knife is extremely important in order that the air is delivered so that the "sharp" air stream shears the coating at some point in the coating layer where the energy of the air stream effectively separates the "pasty" coating near the surface of the paper where the water begins to be absorbed. The Black Clawson Air Knife design consists of an Air Knife Body, usually manufactured from Mild Steel with two stainless steel lips. The bottom lip is curved for good direction of the air stream onto the web and the top lip is flat with adjusting screws along its length for adjustment of overhang and lip gap.

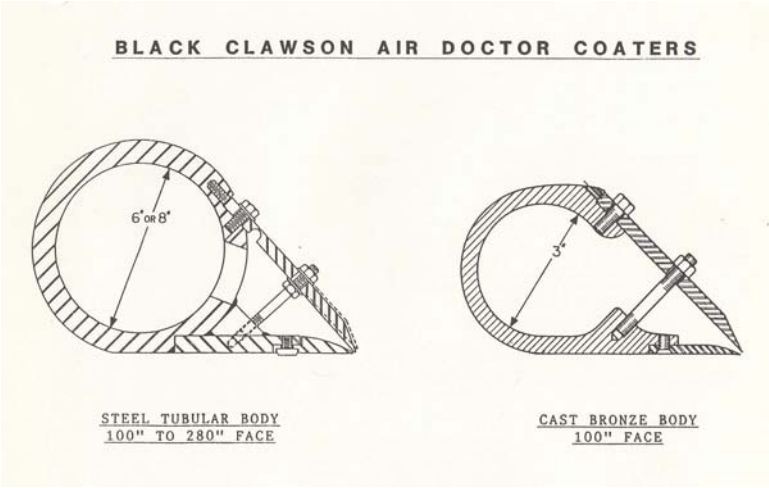

Fig 6. The Black Clawson Air Knife

The Air Knife brackets in which the Air Knife is mounted allow for adjustments in all directions to ensure correct Air Impingement onto the coated paper or board.

- Horizontal Adjustment
- Vertical adjustment
- Angular Adjustment

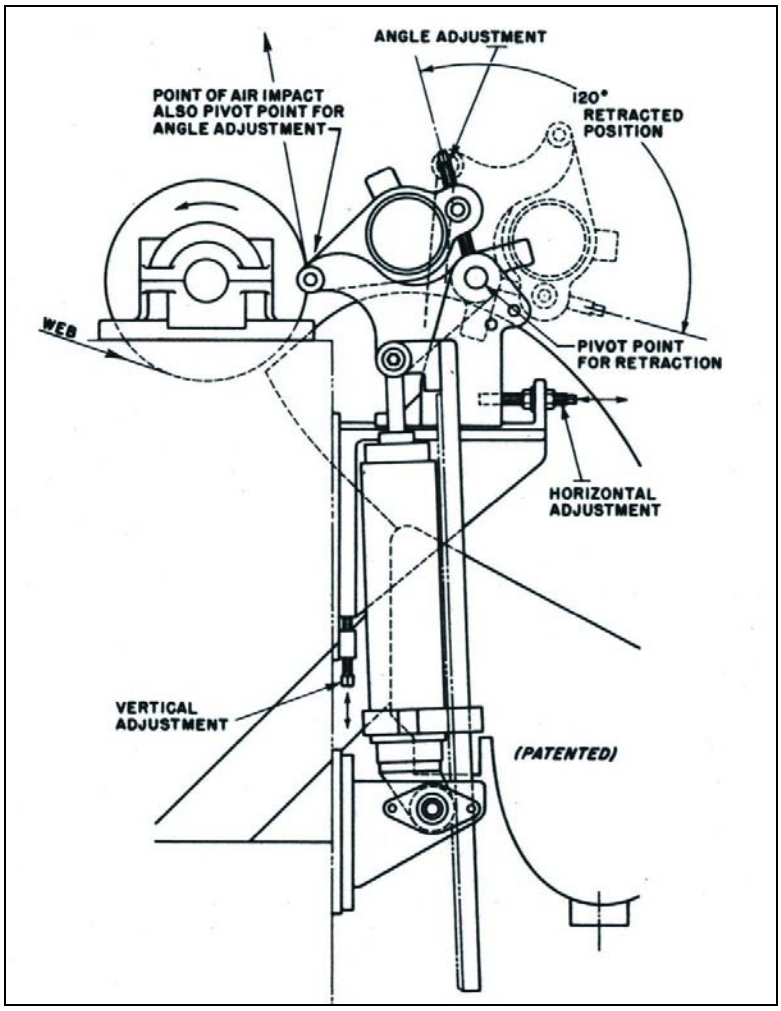

Fig 7. Air Knife Mounting Brackets

The Air Knife Separation Pan is designed to receive the air and excess coating metered from the web by the Air Knife, separate the coating from the air, and return the coating to the coating recirculation system. The model 311 Separation Pan is designed for speeds up to 500 mpm.

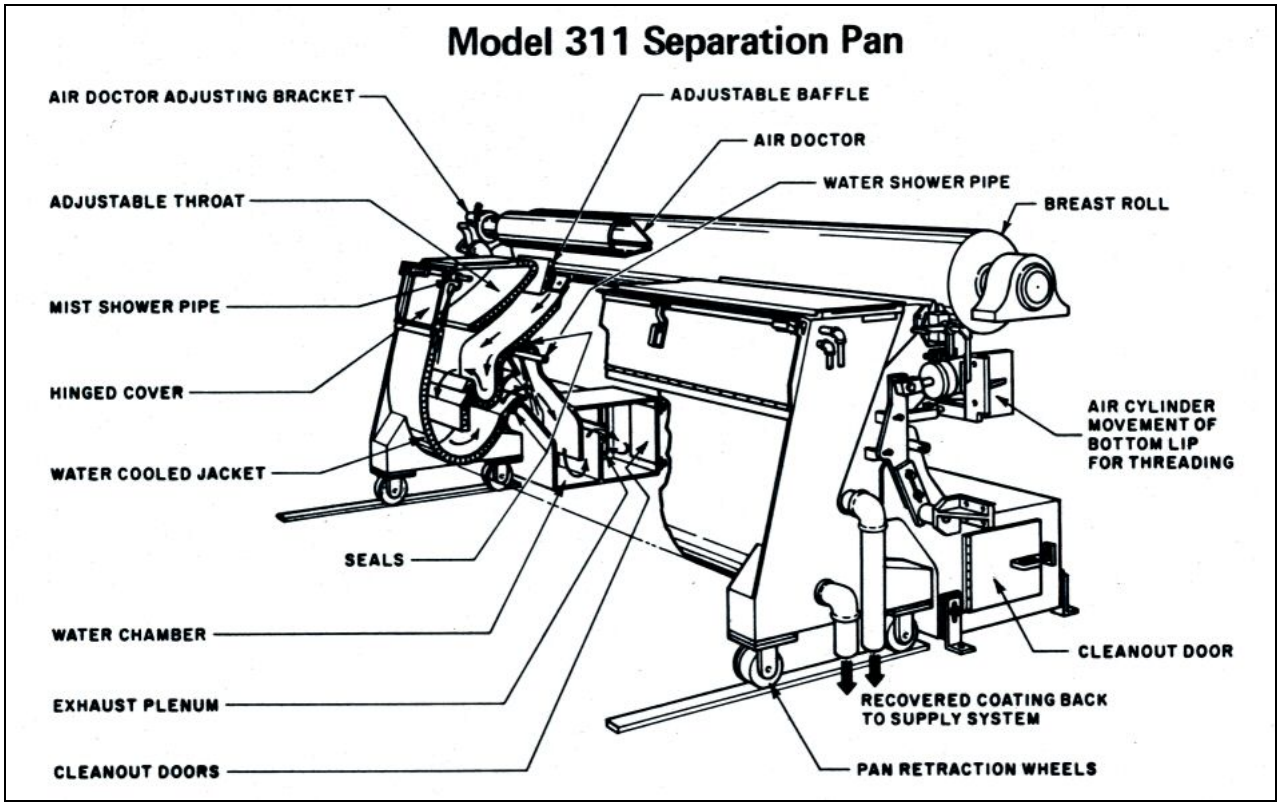

Fig 8. Model 311 Separation Pan

Strengths

- Contour coater, coats rough, uneven surfaces
- Extremely versatile and forgiving
- Easy coat weight control
- Uniformly thick coating

Weaknesses

- Does not work well with high viscosity or high solids
- Clean-up can be messy.

Blade Coater

The most popular method used today for top coating of board is the blade coater. Due to its ability to coat high coat weights with high solids and high viscosity at high speeds, this coater tends to replace the Air Knife Coater for high quality coated board applications such as solid bleached sulphate. It can be used as a pre coater for all double coated applications.

Types of Blade Coater Application.

1. Flooded Nip Roll Applicator
2. Fixed Dwell Fountain application
3. Vari Dwell Fountain application

Roll Blade Coater

The Roll Blade Coater utilises a pan fed driven applicator roll to apply the coating to the sheet. The term “flooded nip” comes from the coater operation which maintains an excess of coating at the nip, keeping the gap flooded at all times. Consequently there is a back fall resulting in a substantial overflow and recirculation from the pan. The applicator roll and the coating pan assembly move as a unit. In the up position they are held firmly against adjustable stops on the mainframe so that the gap between the applicator and backing rolls is controlled and constant. The applicator roll is rubber covered.

Some features incorporated in the Roll Blade Coater are:

- The volume of coating in the system is minimised by contouring in the pan to the applicator roll relationship also eliminates dead pockets.
- A jacketed pan for chilled water circulation to promote sweating of the pan surfaces preventing build up of dry coating which extends pan life between cleanups.
- Coating transfer is controlled by applicator roll speed and gap adjustment.

Blade coaters are used today for a variety of reasons compared to other methods. The most important reasons are

1. Smoother and more level surface for post printing.
2. High speed of operation
3. Higher solids and viscosity

Since the Blade Coater controls weight by scraping off the excess coating, it deposits more coating in the paper’s depressions and less on the very top of the fibers. The differences in these local coat weights can be extensive, sometimes up to 20:1. This is an advantage for creating a level surface, but it is a limitation where uniform coverage is desired to prevent mottling. Blade coaters are rarely used alone to cover up dark or brown rawstocks with white coatings. This limitation can be overcome with a very smooth rawstock and heavy coat weights, where the product can afford the effort to achieve a smooth rawstock, the Blade Coater becomes the coater of choice because it allows high solids as in thermal and CF coated papers. Here uniform layers are required for cost and final image development reasons.

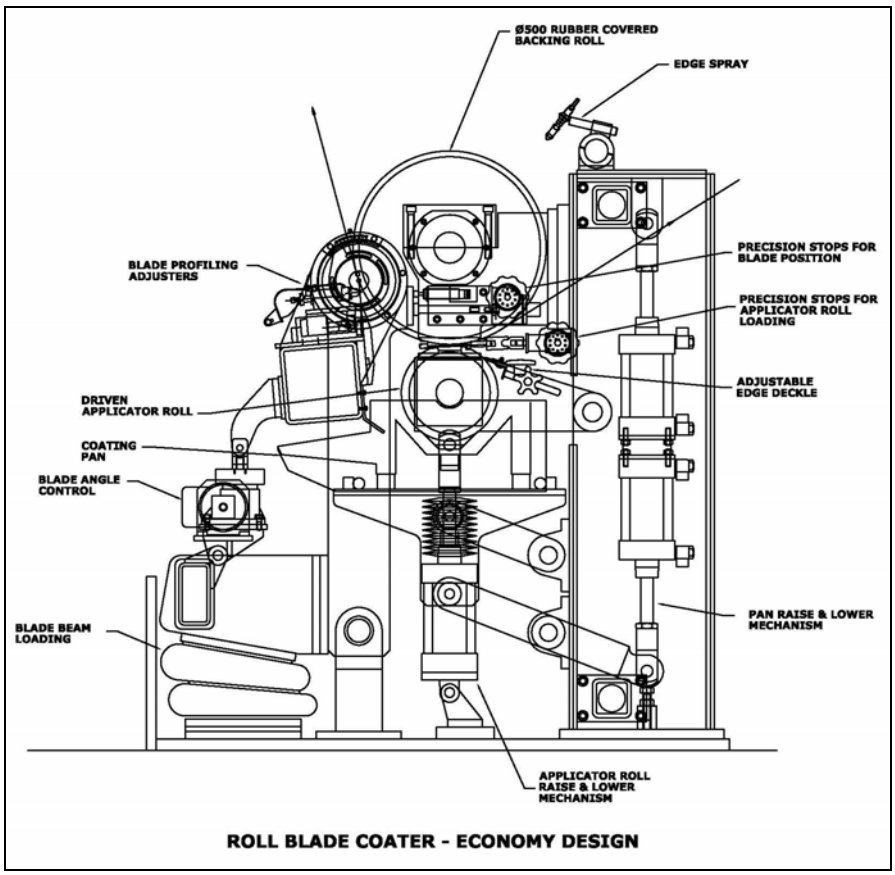

Fig 9. Flooded Nip Roll Blade Coater – Economy design for slower and narrower machines.

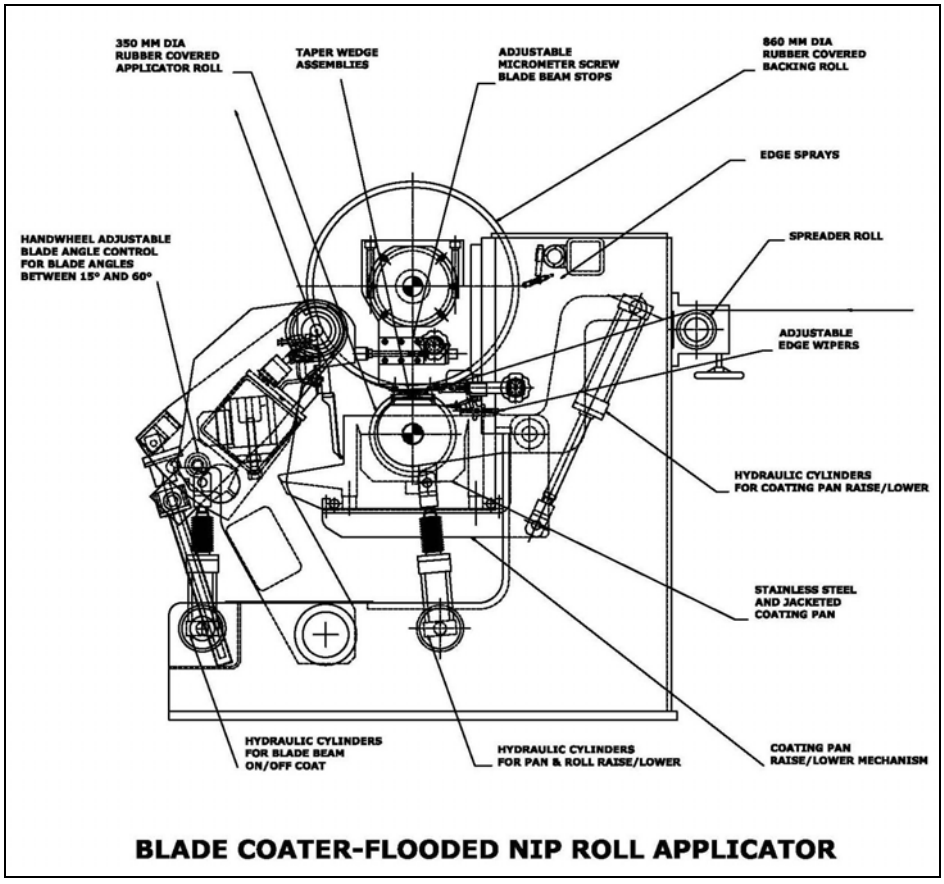

Fig 10. Flooded Nip Roll Blade Coater.

Fountain Blade Coater.

The Fountain Blade Coater utilises a fountain to apply an excess coating to the sheet replacing the applicator roll. The fountain is made from a body with lips mounted to the top. The gap between the lips supplies coating to the web. The fountain is mounted in fixed position in close proximity to the sheet, with the ability to rotate the fountain away from the backing roll for cleanup.

Vari Dwell Fountain Blade Coater.

The Vari Dwell Blade Coater is characterised by its ability to vary, over a wide range, the dwell time/distance of the coating on the base sheet between the points of application and metering by the blade.

The applicator and metering blade assemblies of this coater are arranged in two units entirely independent of each other. This permits the applicator section (jet fountain) to be displaced along the backing periphery, and thus vary the distance between the points of application and metering. Adjustment range is between 80mm and 500mm.

The primary goal in developing the blade coater was to add this key variable application feature without compromising the important operating features.

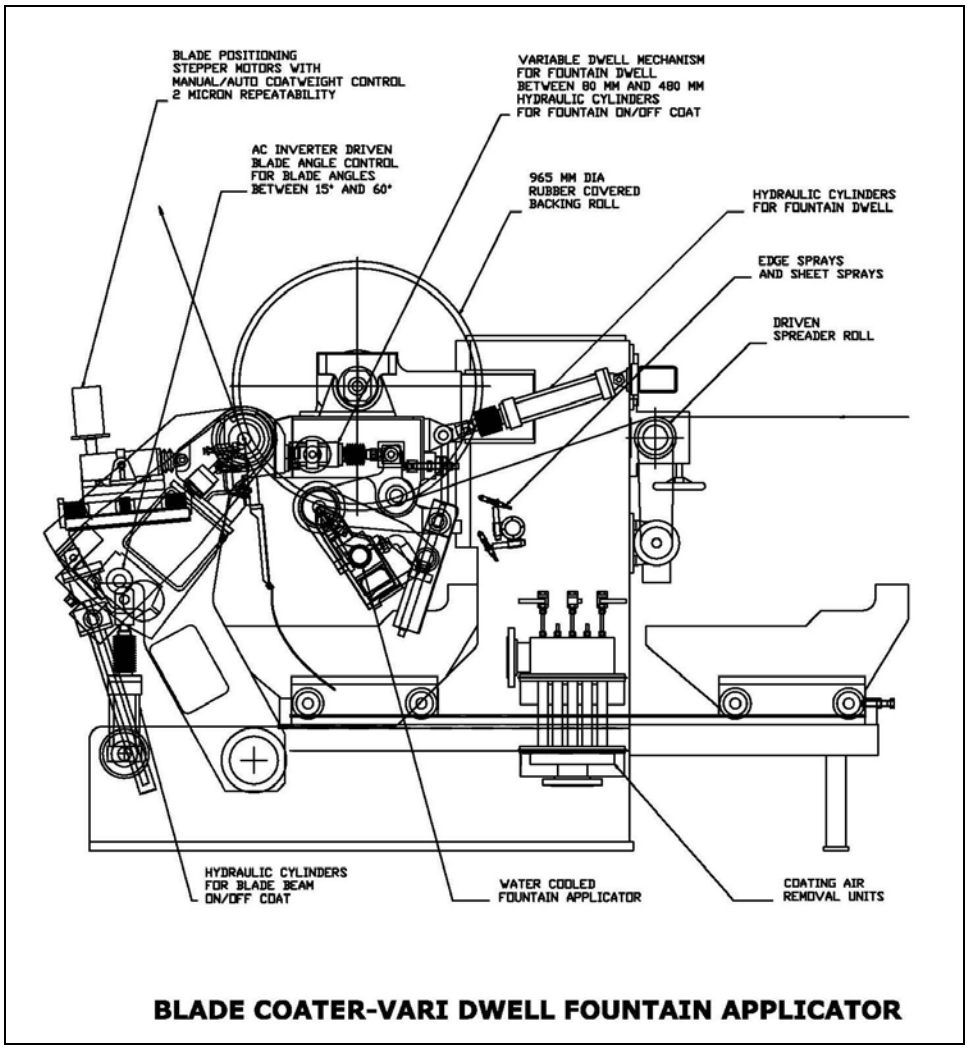

Fig 11. Vari Dwell Fountain Blade Coater

Blade Configurations.

There are two major types of blade arrangements, the bevelled blade and the bent blade. The rules of operation for a bent blade are easy to understand and apply – the coat weight increases with speed, solids, viscosity, and lower blade pressures. The bevelled blade is the most widely used and unfortunately is much more complex.

The final coat weight and other qualities can be optimised by a series of factors in the bevelled blade coating process. The major factors include:

1. Blade force or pressure
2. Speed
3. Blade thickness
4. Blade angle
5. Application method
6. Solids
7. Viscosity and rheology (pigment shapes and polymer properties)
8. Raw stock
9. Coating formulation (levels and selection of materials)

Types of Blade Coater Metering.

1. Bevel Blade (Rigid)
2. Bent Blade
3. Rod

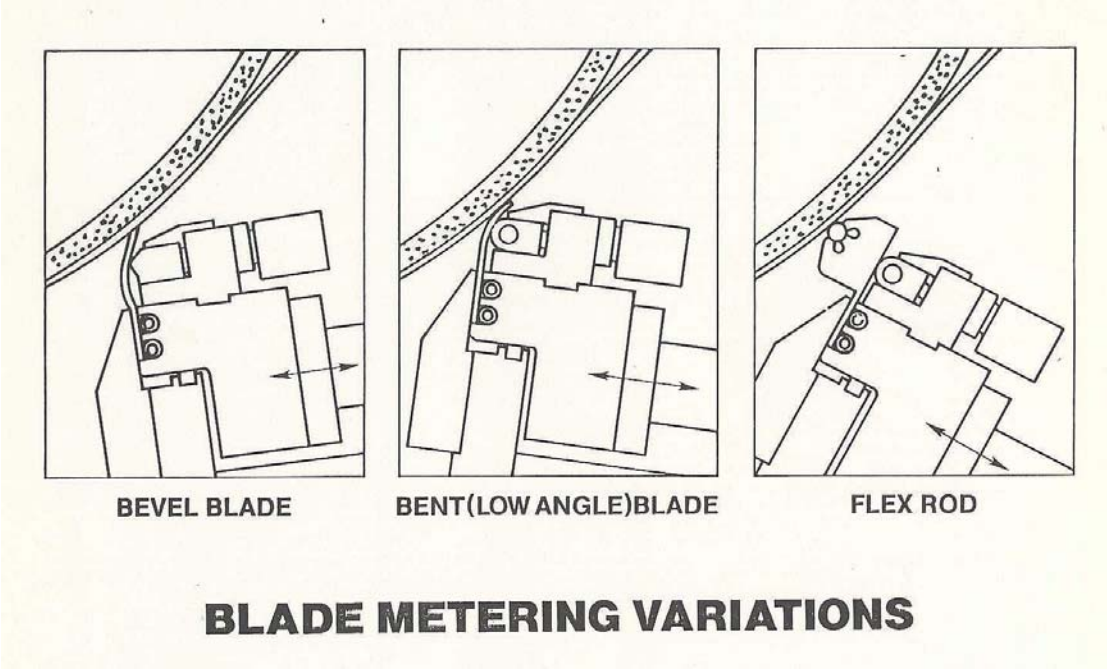

Fig 12. Blade Metering Variations

Most operations optimise these factors by a series of pilot or production trials. These trials are often guided by the engineer's concept of how the bevelled blade coater works, as the subject is too complex for a thorough, theoretical examination of all factors combined.

Strengths

- High Speed
- Excellent coat weight range
- Very smooth coating

Weaknesses

- High coating circulation requirement, especially with fountain
- Local coating thickness variations
- Non uniform fiber coverage. (non contour)